4th QUARTERLY REPORT – PUBLIC PAGE
DTPH56-14-H-00002
"Full Scale Testing of Interactive Features for Improved Models"

SUBMITTED BY: **Team Project Manager**
Deborah Jelen
Electricore, Inc
27943 Smyth Drive, Suite 105
Valencia, CA 91355
Telephone: (661) 607-0260
E-mail: jelen@lelectricore.org

TEAM TECHNICAL COORDINATOR: **Team Technical Coordinator**
Aaron Dinovitzer
BMT Fleet Technology
311 Legget Drive
Kanata, Ontario K2K 1Z8 Canada
Telephone: (613) 592-2830
E-mail: adinovitzer@fleetech.com

Team Technical Coordinator
Mures Zarea
GDF SUEZ, R&I Department
361 Ave du President Wilson
B.P. 33, 93211 Saint-Denis, France
Telephone: +3 (366) 413.5637
Email: mures.zarea@gdfsuez.com

TEAM PARTICIPANTS: Electricore, Inc.
BMT Fleet Technology
GDF Suez
Pipeline Research Council International (PRCI)

SUBMITTED TO: U. S. Department of Transportation
Pipeline and Hazardous Materials Safety Administration
Mr. Warren D. Osterberg
Agreement Officer
warren.osterberg@dot.gov

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1.0 Results and Conclusions

Task 2: Material Selection, Acquisition, and Characterization
GDF SUEZ is continuing their characterization work in preparation for Tasks 5a, 5c and 6. This includes measuring the transverse and longitudinal tensile properties of Pipe 5, 7 and, SCC-1.

The Charpy impact values for Pipe 7 have been added to the other previously measured values.

The toughness characterization of Pipe 5 is in progress. With the Charpy values added during this quarter, the Pipe 7 material characterization performed by GDF SUEZ is finished.

BMT carried out the fracture toughness and strain life fatigue tests on Pipe D (24 inch diameter, 0.375 inch wall thickness, Grade X-70, 1998 vintage pipe).

CTOD tests were carried out on base material, weld metal (girth weld) and 50% heat affected zone (HAZ).The test temperature was -5^{o}C.

Strain life fatigue tests were carried out on the base material. The specimen orientation was along the pipe longitudinal axis.

Task 3: Baseline Existing Features
There is no work to report during this reporting period on Task 3.

Task 4: Full Scale Testing of Complex Dents
BMT has been working under a PRCI contract (MD 4-9) to develop dent fatigue life assessment and severity ranking criteria. The dent assessment criteria is based on dent shape, pipe geometry, dent restraint and operating conditions and is applicable to a wide variety of dent scenarios. However, there were a few scenarios where there was not a good correlation between dent shape parameter and fatigue life, for example, the dents created with round bar indenters producing highly asymmetric shapes both in axial and circumferential orientation.

A preliminary dent fatigue test matrix prepared for the current test program includes round bar indenters to fulfil the gap identified in the PRCI MD 4-9 project work. The final selection of fatigue test matrix involved creating several dent finite element (FE) models using a range of round bar diameters, indenter lengths, indentation travel, indenter orientation relative to the pipe axis and restraint condition.

Dents will be created in the dent rig that includes an actuator with 120,000 lbs capacity. The actuator capacity can be upgraded to 250,000 lbs capacity using the current dent frame. Cyclic pressure will be generated using the pump, capable of total water flow of 40 gallons per minute (GPM) at continuous operating pressure of 3500 psi. The test system is capable of running two tests simultaneously.

Task 5a: Dent and Gouge Severity
For Task 5a, GDF SUEZ has created three dent and gouge defects.

The dent depths are measured by LVDT (Linear Variable Differential Transformer). The gouge depths are deduced from residual thickness measurements with ultrasonic (UT) sensors. The gouge depth is evaluated as the difference between measured pipe thickness and measured residual thickness. Following this mapping, the deepest local dent and the deepest local gouge depths were indicated for the three defects. The measurements are made without internal pressure. The test duration until pipe burst was about twelve minutes.

Task 5b: Interaction between Defects
There is no work to report during this reporting period on Task 5b.

Task 5c: Dent and Gouge Defects Removed from Service
Pipe 7 was removed from service, as it contained a dent and gouge defect, called 7.ext1.2. The measurements are made without internal pressure.

Defect 7.ext1.2 found in service was burst tested, and it failed by rupture at 166 bar. The test duration until pipe burst was about fourteen minutes.

Task 6: SCC Colonies and SDO Modeling Coordination
A specific SCC crack sizing equipment was delivered to GDF SUEZ CRIGEN in December 2014. It is a Grid Station D8000β equipment by Jentek with two sensors: a FA28 MWM sensor for crack mapping and a FA214 MWM sensor for crack depth estimation. Magnetic particle inspection was performed on the SCC colonies on the SCC-1 vessel and will be successively compared to MWM crack mapping.

Preliminary results are presented for the shallowest defect (B9 colony) and are illustrated by the comparison of the magnetic particle inspection (MPI) results and the C-scan with MWM. We observe a good match in terms of mapping between MPI and magnetic permeability C-scan data.

Crack depth estimation for each crack cluster is ongoing, and results still need interpretation and cross-check, due to the use of new measurement equipment.

C-scan crack mapping and C-scan crack depth need to be cross-linked in order to identify what could be the driving crack / crack string in each SCC colony.

Task 8: Dissemination of Results
The project team held monthly internal meetings with the Technical Advisory Committee (TAC).

Task 9: Project Management and Reporting
The project team held regular teleconference meetings to track performance, schedule and budget.

PHMSA issued a contract modification to obligate the full federal award. Electricore issued subcontract modifications to our partners.

Task 10: Kiefner & Associates Communication and Data Sharing

On September 24, 2014, the team met with Kiefner/Applus-RTD (DTPH-5614-H-0004) to coordinate project information and data sharing.

2.0 Plans for Future Activity

Task 2: Material Selection, Acquisition, and Characterization
GDF SUEZ will complete the material characterizations for selected samples from:

- A vintage 24 inch diameter pipe provided by an US transmission pipeline operator for Task 5.
- Two (2) 18 inch diameter pipe sections containing SCC colonies for Task 6.

BMT is in discussion with several pipeline operating companies soliciting pipe with corrosion features to be used for creating dents interacting with realistic corrosion features

Task 3: Baseline Existing Features
GDF SUEZ will continue searching for pipe sections retrieved from service containing in-service created dents and gouges.

Task 4: Full Scale Testing of Complex Dents
BMT will fabricate the round bar indenters, finalize the test procedure and instrumentation plan for plain dent fatigue testing.

Task 5a: Dent and Gouge Severity
GDF SUEZ will perform the fatigue test on the defect 5.4.3.

Task 6: SCC Colonies and SDO Modeling Coordination
GDF SUEZ will continue to work on the vessel preparation.